



Freeport Area Master Plan Project - ERCOT Independent Review Update

October 19, 2017

Freeport Area – Steady State Base Case Violations

- Detailed results for Steady State Violations were presented in Aug 2017 RPG¹
- Base Case Violations Summary ->

Year	Thermal	Voltage
2019	None	None
2020	Yes	Yes
2022	Yes	Yes

¹ Detailed results can be found in Aug 22nd 2017 RPG Freeport EIR Update presentation - <http://www.ercot.com/calendar/2017/8/22/108879-RPG>

Bridge The Gap Upgrades

- To resolve the base case violations CNP's 'Bridge The Gap Upgrades' were applied to 2020 and 2022 steady state cases.
- The list of these upgrades include ->
 1. Loop 345 kV South Texas Project (STP) – Dow-Velasco circuit 27 into the Jones Creek Substation (approximately 0.9 mile)
 2. Install 7-ohm in-line reactors at the Jones Creek Substation on 345 kV STP – Jones Creek circuits 18 and 27
 3. Install 3rd 345/138 kV 800/1000 MVA Autotransformer at the Jones Creek Substation
 4. Install 4th 138 kV Capacitor Bank (120 MVAR) at Jones Creek Substation
 5. Install 1st 138 kV Automatically Switchable Capacitor Bank (140 MVAR) at Jones Creek Substation
 6. Install 2nd 138 kV Automatically Switchable Capacitor Bank (140 MVAR) at Jones Creek Substation
- Total cost estimate for all these upgrades is \$32.3M.

2020 Steady State Violations After Bridge The Gap Upgrades

- **NERC P1, P2-1, P7** -> No Violations
- **NERC P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5** -> No Violations
- **NERC P3 (G-1 + N-1)** ->

# Unsolved Contingency	Branch Violations			Bus Violations
	Element	kV	Max. Loading (%)	
None	Oasis to WA Parish	345	100.4	Low Voltages at seven 138kV buses (between 0.9 to 0.91 PU) -> Basf, Booster, Brazos Port, Copper, Sea Doc, Seaway and Sea Doc Tap
	Basf to Hofman	138	136.3	
	Hofman to LK Jack	138	107.8	

- **NERC P6-2 (X-1 + N-1)** -> No Violations

2022 Steady State Violations After Bridge The Gap Upgrades

- NERC P1, P2-1, P7 -> No Violations
- NERC P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5 -> No Violations
- NERC P3 (G-1 + N-1) ->

# Unsolved Contingency	Branch Violations			Bus Violations
	Element	kV	Max. Loading (%)	
None	Oasis to WA Parish	345	101.73	Low Voltages at eight 138kV buses (between 0.88 to 0.9 PU) -> BASF, Hofman, Booster, Brazos Port, Copper, Sea Doc, Seaway and Sea Doc Tap
	BASF to Hofman	138	142.32	
	Hofman to LK Jack	138	112.54	

- NERC P6-2 (X-1 + N-1) -> No Violations

Note:- Some of the 138kV issues will not be addressed in this EIR. CNP has other plans to address these issues separately.

2022 Maintenance Outages (P6-1, P6-3)

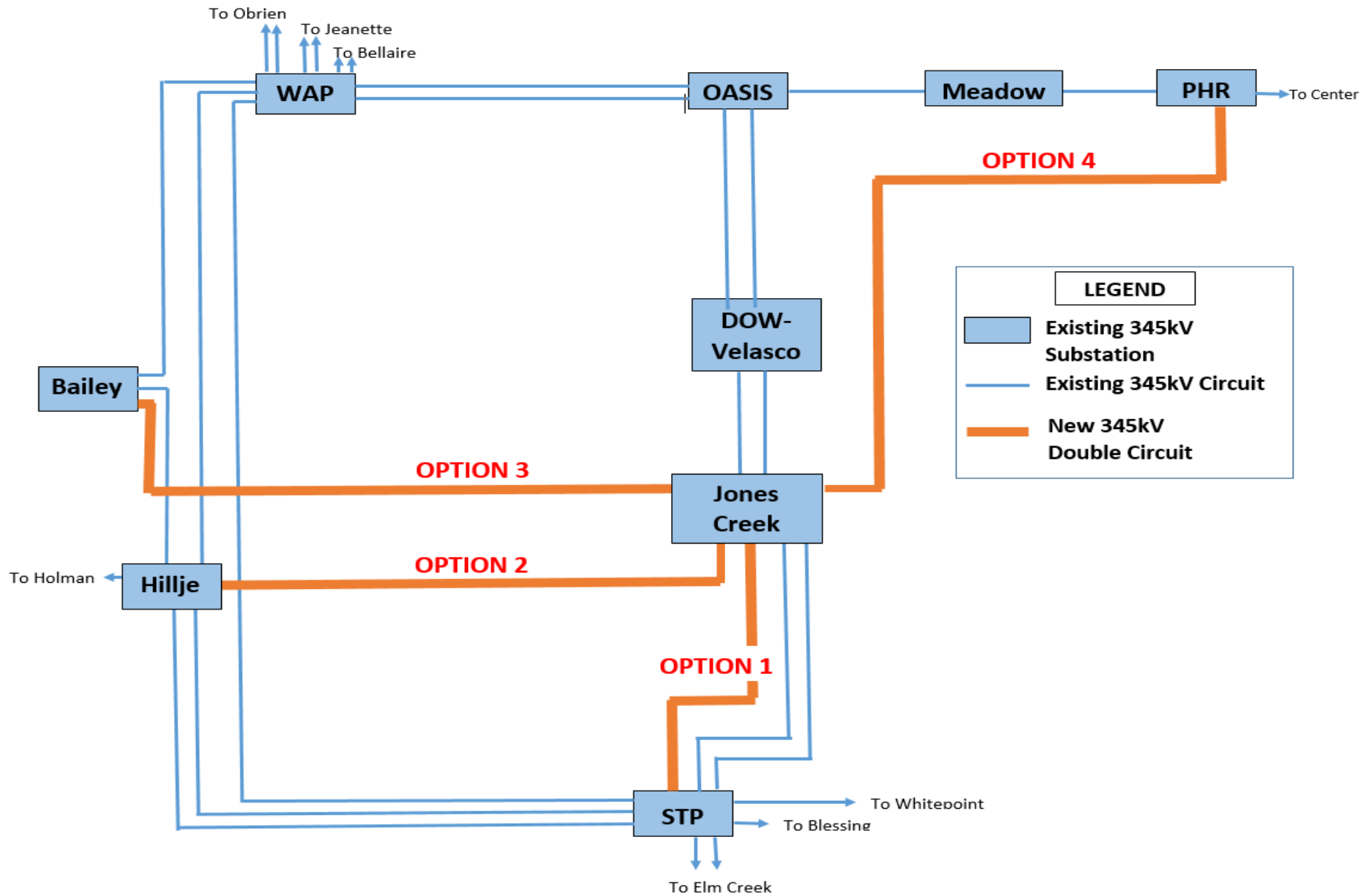
- Out of the total 2275 MW of Freeport area load, about 94% is industrial
- N-1-1 Analysis was performed on Off-Peak Load Case (Load was 6% lower than summer peak in Coastal zone based on RT data)
- Maintenance Outage Scenarios considered ->
 - M1 – Dow to Oasis Ckt 18
 - M2 – Dow to Jones Creek Ckt 18
 - M3 – Jones Creek to STP Ckt 18
 - M4 – Jones Creek Switched Shunt 140MVAr
- No Voltage Violations observed
- Thermal Violations ->

Element	Contingency	kV	Max. Loading (%)			
			M1	M2	M3	M4
Oasis to DOW Ckt 27	STP to Jones Creek Circuits 18 & 27	345	135.8	-	-	-
STP to Jones Creek Ckt 27	Dow to Oasis Circuits 18 & 27 and Oasis to WAP Ckt 18	345	-	-	109.2	-

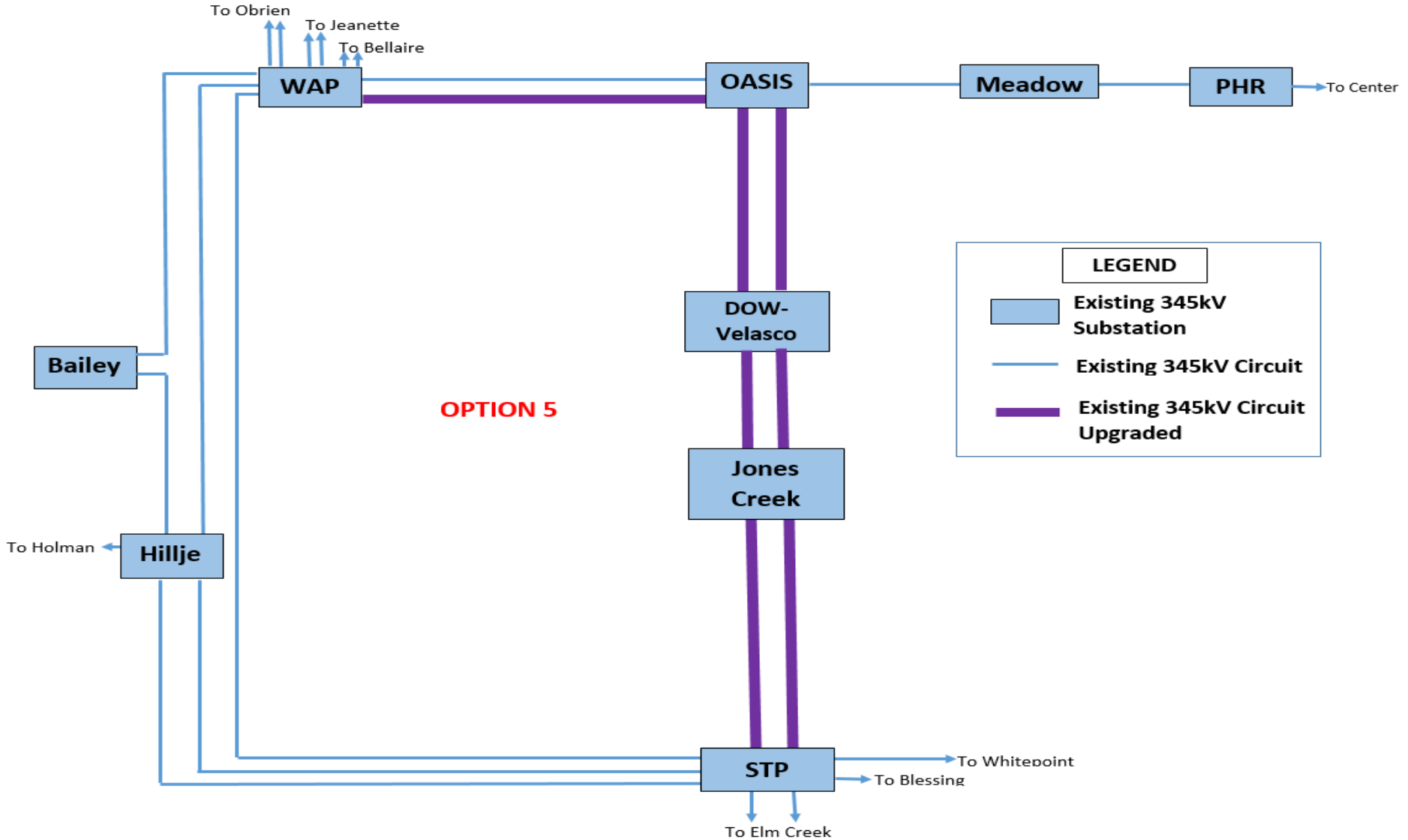
Options Considered

- **Option – 1**: New Double Circuit 345kV line from STP to Jones Creek (50.4 miles); Upgrade DOW to Jones Creek 345kV Circuits 18 & 27
- **Option – 2**: New Double Circuit 345kV line from Hillje to Jones Creek (62.4 miles); Upgrade DOW to Jones Creek 345kV Circuits 18 & 27
- **Option – 3**: New Double Circuit 345kV line from Bailey to Jones Creek (48 miles); Upgrade DOW to Jones Creek 345kV Circuits 18 & 27
- **Option – 4**: New Double Circuit 345kV line from PHR to Jones Creek (60 miles)
- **Option – 5**: Existing System Upgrade
 - Oasis to WAP 345kV Circuit 99
 - DOW to Oasis 345kV Circuits 18 & 27
 - DOW to Jones Creek 345kV Circuits 18 & 27
 - STP to Jones Creek 345kV Circuits 18 & 27

New Line Options



Option – 5 (Line Upgrades)



Option 1

- New Double Circuit 345kV line from STP to Jones Creek (50.4 miles); Upgrade DOW to Jones Creek 345kV Circuits 18 & 27
- Cost Estimate - \$ 223.2 Million

Contingency	Bus Violations	Branch Violations
P1, P2-1, P7	None	None
P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5	None	None
G-1 + N-1 (P3)	None	None
X-1 + N-1 (P6-2)	None	None
N-1-1 (P6-1, P6-3)	None	None
Extreme Event	Unsolved Contingency	

Option 2

- New Double Circuit 345kV line from Hillje to Jones Creek (62.4 miles); Upgrade DOW to Jones Creek 345kV Circuits 18 & 27
- Cost Estimate - \$ 272.5 Million

Contingency	Bus Violations	Branch Violations
P1, P2-1, P7	None	None
P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5	None	None
G-1 + N-1 (P3)	None	None
X-1 + N-1 (P6-2)	None	None
N-1-1 (P6-1, P6-3)	None	None
Extreme Event	No unsolved contingency	

Option 3

- New Double Circuit 345kV line from Bailey to Jones Creek (50.4 miles); Upgrade DOW to Jones Creek 345kV Circuits 18 & 27
- Cost Estimate - \$ 214.4 Million

Contingency	Bus Violations	Branch Violations
P1, P2-1, P7	None	None
P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5	None	None
G-1 + N-1 (P3)	None	None
X-1 + N-1 (P6-2)	None	None
N-1-1 (P6-1, P6-3)	None	None
Extreme Event	No unsolved contingency	

Option 4

- New Double Circuit 345kV line from PHR to Jones Creek (60 miles)
- Cost Estimate - \$ 220.0 Million

Contingency	Bus Violations	Branch Violations
P1, P2-1, P7	None	None
P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5	None	None
G-1 + N-1 (P3)	None	None
X-1 + N-1 (P6-2)	None	None
N-1-1 (P6-1, P6-3)	None	None
Extreme Event	Unsolved Contingency	

Option 5

- Line Upgrade of the following circuits

Oasis to WAP 345kV Circuit 99;
DOW to Jones Creek 345kV Circuits 18 & 27;

DOW to Oasis 345kV Circuits 18 & 27;
STP to Jones Creek 345kV Circuits 18 & 27;

- Cost Estimate - \$281.8 Million

Contingency	Bus Violations	Branch Violations
P1, P2-1, P7	None	None
P2-2, P2-3, P4-2, P4-3, P4-4, P4-5, P5	None	None
G-1 + N-1 (P3)	345kV buses = 7	None
X-1 + N-1 (P6-2)	None	None
N-1-1 (P6-1, P6-3)	None	None
Extreme Event	Unsolved Contingency	

- Option 5 has seven 345kV (Tomball, Obrien, Bellaire, Zenith, Kuykendahl and Rothwood) bus violations under P3

Dynamic Study Results

- Data:
 - LT2023 DWG Flat start data set
 - CNP Load model v4
 - Contingencies filtered by counties in and around the study area – Brazoria, Matagorda, Wharton, Fort Bend, Galveston and Southern Harris
 - CNP Freeport related buses loads were modified to match the steady state case and signed projections
 - Bridge the Gap upgrades and DOW 4th Auto were added to the base case

Contingencies and Study Methodology

- Phase I – Used VSAT analysis to identify top contingencies and buses of interest
- All dynamic events related to these elements – P1, P2, P4, P5 and P7
- Extensive simulation of event combinations for P3 and P6
- Sources of contingencies:
 - VSAT study results
 - DWG contingency dataset
 - Internal ERCOT prepared P3 list (for generators)

Transient study results

Case	Topological Changes	Contingency Category					
		P1	P2	P3	P4, P5	P6	P7
LT2023 SP	BTG Upgrades + DOW 4 th Auto	Stable	Stable	Stable	Stable	Stable	Stable

○ Conclusions from study results:

- Meets NERC reliability criteria
- No Non-consequential load shed for P3 or P6 contingencies
- No post fault voltage recovery issues for buses in the project area. Meets ERCOT recovery criteria (0.9 p.u. within 5 seconds for P1 and within 10 seconds for P2-P7)

Next Steps

- Complete the Steady State and Dynamic Stability Analysis
- Transfer Capability Analysis
- Economic Analysis
- Evaluate project alternatives
- Sensitivity Analysis –
 - Higher Load (potential loads)
 - PG Section 3.1.3 (4)
- Tentative Timeline
 - Final EIR update to RPG – November
 - EIR recommendation to TAC – November
 - BOD Endorsement – December

